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ABSTRACT

This study examined whether scripts provide a basis for the categories preschool children use to structure their semantic memories and whether the use of taxonomies to structure memory becomes more common only after children enter elementary school. Subjects were 108 children in three equal groups of 18 boys and 18 girls children each of 4-, 5-, and 6-year-olds. In each group, subjects were randomly assigned to either the taxonomy list condition or the script list condition. After being exposed to either taxonomy-based or script-based memory strategies, children were then shown pictures of clothing, animals, and food, and asked to remember the words those pictures represented. The subjects differed significantly in the number of words, categories, and words-per-category recalled. These differences were a function of age group and condition. Highest recall was in the 6-year-old/taxonomy list condition, followed by: (1) the 4-year-old/script list condition; (2) the 5-year-old/script list condition; (3) the 5-year-old/taxonomy list condition; and (4) the 4-year-old/taxonomy list condition. These data show a developmental shift in language learning. Results suggest that script-based memorization strategies have much utility for younger children; and, perhaps due to older children's exposure to the formal educational system, hierarchically-based memorization strategies become more salient for elementary school students. (Contains 11 references.) (JW)

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SEMANTIC MEMORY ORGANIZATION IN YOUNG CHILDREN: THE SCRIPT-BASED CATEGORIZATION OF EARLY WORDS.

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Introduction

This study tested the hypotheses that (a) "scripts" (types of event sequences) provide a basis for categorical structures in the semantic memories of young children, and (b) it is only later that children develop the use of more complex "taxonomic" categorical structures (types of hierarchical groupings).

Traditionally, researchers have focused on the development of taxonomic categories in their attempts to better understand how information is organized in children's memories (Mandler, 1979; Markman, 1984). Essentially, taxonomies involve categories that are derived from an association of items from different scripts (for e.g., a *lion* [that lives in the jungle] and a *tabby* [that lives at home] are *ANIMALS* that belong to the *CAT* family). Recent studies, however, have indicated the need for alternative explanations of categorization and related cognitive processes (Adams, 1985; Adams and Bullock, 1986; Lucariello & Nelson, 1985, 1986). In particular, the Lucariello and Nelson model calls for a more socially oriented perspective in which concept development and categorization are viewed as products of event or activity-based acquisition processes. This model is founded on the assertion that learning processes are embedded in activities (scripts) and therefore, thinking and speaking have meaning only in relation to those activities. Scripts are thought to involve categories that are derived from an association of items with their functional roles within event sequences and thus with each other (for e.g., a *lion*, a *tiger*, and a *monkey* are *ANIMALS* that *live in the JUNGLE*).

In testing the hypothesis that script-based categorization enters into semantic organization as the first and most salient memory structure, Lucariello and Nelson examined memory task performances of 4-year-old children. The present study, conducted in New Zealand, was a development of the Lucariello and Nelson study (Experiment 1) and examined memory task performances of 4-year-old, 5-year-old, and 6-year-old children. This allowed for a reexamination of the nature of young children's semantic memory structures, as well as an examination of the stage of transition from script-based to taxonomy-based categorization. The results support the hypotheses that script-based structures form the basis for early cognitive processes and that the development of taxonomic categorical structures comes later. In light of these findings, future research should examine the processes which enable the language user to eventually determine the superset, basic set, and subset relations that characterize the hierarchical organization of taxonomic categories.

Method

Subjects

One hundred and eight children, 36 four-year-olds (18 boys and 18 girls; mean age of 4 years and 5 months), 36 five-year-olds (18 boys and 18 girls; mean age of 5 years and 5 months), and 36 six-year-olds (18 boys and 18 girls; mean age of 6 years and 4 months) served as subjects. From the thirty-six children in each age group, eighteen (9 boys and 9

girls) were randomly assigned to either (a) a taxonomy list condition consisting of categories of items sharing similar attributes/functions, but from different scripts (for e.g., *ANIMALS: lion, cat, horse*), or (b) a script list condition consisting of categories of items sharing similar attributes/functions within the same script (for e.g., *ANIMALS: lion, giraffe, bear*).

Materials

In a pilot study, two nine-word recall lists were constructed from responses elicited from thirty children (age range from 4 years and 0 months to 6 years and 11 months). In keeping with the Lucariello and Nelson study, questions were asked about objects associated with a single action in a given script (in the categories of clothes, animals, and food):

1(a) What piece of *clothing* you would wear to bed?
1(b) What piece of *clothing* you would put on to go outside?
1(c) What piece of *clothing* you would put on in the morning?
2(a) What *animal* you would see at the zoo?
2(b) What *animal* you would have as a pet?
2(c) What *animal* you would see on a farm?
3(a) What *food* would you eat for breakfast?
3(b) What *food* would you eat for lunch?
3(c) What *food* would you eat for dessert?

In compiling the taxonomy list, the most common responses to the (a) questions (viz., pajamas, lion, cereal), the second most common responses to the (b) questions (viz., jeans, cat, cheese), and the third most common responses to the (c) questions (viz., shirt, horse, apple) were selected. Hence, this list was composed of the more familiar and typical associates for each subcategory, although, not the strongest.

In compiling the script list, responses to subcategory questions 1(b), 2(a), and 3(b) were collected. The most common responses (viz., jeans, lion, sandwich), the third most common responses (viz., jacket, giraffe, cheese), and the fifth most common responses (viz., socks, bear, apple) were selected. This was in keeping with the composition of the taxonomy list, where members less strongly associated to the subcategories, although still considered typical exemplars, were chosen.

Procedure

Each child was tested individually. The following instructions were given: "We are going to play a game. We are going to say some words and look at some pictures. First, I'll say a word, show you a picture, and then you say the word. When we have said all the words and looked at all the pictures, I'm going to ask you how many you can remember." The experimenter then read the words and presented the picture cards at a rate of one approximately every 3 seconds, allowing the child to repeat each word before going on to the next. The cards were realistic, colored photographs, approximately 3" x 5" in size. Each card was removed after the child said the corresponding word. After all the words and cards

were presented, the child was given the retrieval cue: "Tell me all the things we just said"? As in the Lucariello and Nelson study, all children received three trials. There was a small break of approximately 30 seconds between each trial. The items on each list were presented in a blocked order (clothes, animals, food) and list order was constant across trials.

Results

This study examined the following:

1. If scripts provide a basis for categorical structures in children's semantic memories, it is expected that greater numbers of words, categories, and words-per category will be recalled by younger children in the script list condition than in the taxonomy list condition.
2. If it is only later that children develop the use of more complex taxonomic categorical structures, it is expected that greater numbers of words, categories, and words-per-category will be recalled by older children in the taxonomy list condition.

Recall as a Function of List Type/Age Group Condition

A 6 (list type: taxonomy, script/age group: 4-year-old, 5-year-old, 6-year-old) x 3 (trial: 1, 2, 3) mixed model ANOVA with list type/age group condition as a between-subjects factor and trial as a within-subjects factor was performed on the data. This allowed a comparison of memory performance of 4-year-old, 5-year-old, and 6-year-old children in the taxonomy list condition with memory performance of 4-year-old, 5-year-old, and 6-year-old children in the script list condition. The overall measure of total words (W), the component measure of categories recalled (C), and a component measure of words-per-category recalled (W/C) were entered into separate analyses.

Words (W) Recalled.

As predicted, the ANOVA performed on the W measure revealed a significant difference in the number of words recalled among the six list type/age group conditions ($p < .01$), and the number of words recalled each time the task was administered ($p < .01$). A Newman-Keuls test applied to the means showed the following order in list type/age group condition, ranging from greatest to least mean number of words recalled, for the first trial and second trials; taxonomy list/6-year-old group, script list/4-year-old group, script list/6-year old group, script list/5-year-old group, taxonomy list/5-year-old group, and taxonomy list/4-year-old group

There was a significant difference between memory performance in the taxonomy list/4-year-old group condition and all other conditions in the both trials ($p < .05$, in each case). In the third trial, children in the taxonomy list/6-year-old group condition scored significantly higher than children in the taxonomy list/5-year-old, script list/4-year-old, and taxonomy list/4-year-old group conditions ($p < .05$, in each case). There were no significant differences among memory performances in the script list/6-year-old, script list/5-

year-old, taxonomy list-5-year-old, and script list/4-year-old group conditions.

Categories (C) Recalled.

The ANOVA performed on the C measure confirmed the prediction that there would be significant differences in the number of categories recalled among the six list type/age group conditions ($p < .01$). It was also revealed that the number of categories recalled did not remain constant each time the task was administered ($p < .01$). A Newman-Keuls test applied to the means showed the following order in list type/age group condition, ranging from greatest to least number of categories recalled for the first trial; script list/4-year-old group, taxonomy list/6-year-old group, script list/6-year-old group, script list/5-year old group, taxonomy list/5-year-old group, and taxonomy list/4-year-old group.

There was a significant difference between memory performance in the taxonomy list/4-year-old group condition and all other conditions ($p < .05$). Although there was no statistically significant results in the second trial, children in the script list/4-year-old group condition recalled more categories than all other conditions, with children in the script list/6-year-old and taxonomy list/6-year-old conditions recalling the next greatest number of categories. Children in the taxonomy list/4-year-old condition recalled the least number of words. In the third trial there were no significant differences in performance among groups, although again, children in the taxonomy list/4-year-old group scored least well.

Words-Per-Category (W/C) Recalled.

The results from the ANOVA performed on the W/C measure supported the prediction that there would be significant differences in the number of words-per-category recalled among the six list type/age group conditions ($p < .01$), and in the number of words-per-category recalled each time the task was administered ($p < .01$). A Newman-Keuls test applied to the means showed a similar order in list type/age group condition to those found on the W and C measures. In all trials, children in the taxonomy list/6-year-old group condition recalled more words-per-category than all other conditions. Children in the taxonomy list/4-year-old group recalled significantly fewer words-per-category than children in all other list type/age group conditions ($p < .05$).

Discussion

Recall as a Function of List Type/Age Group Condition

As hypothesized, there were significant differences in the number of words, categories, and words-per-category recalled as a function of list type/age group. A pattern emerged that remained consistent across trials; recall was consistently highest in the taxonomy list/6-year-old group condition, followed (in order) by the script list/4-year-olds and script list/6-year olds, the script list/5-year-olds, the taxonomy list/5-year-olds, and the taxonomy list/4-year-olds.

The higher memory performance of script list/4-year-olds and consistently lowest performance of taxonomy list/4-year-olds lends strong support to the notion that children of this age are more interested in constructing script-based relations among objects than constructing taxonomic relations. However, it is important not to overemphasize these results. For example, Bruner, Olver, & Greenfield (1966) argued that children of this age lack taxonomic categories and categorize solely on the basis of thematic (script-based) organization. A more reasonable explanation is that relational structures, such as events and themes, are a more common way of making sense of encounters, especially for young children. Taxonomy-based categories with their more abstract hierarchical levels of superordinate, basic, and subordinate items, on the other hand, are part of an organizational system that arises from the process of learning the language. It is not surprising, then, that children who are of an age of limited language experiences, prefer to categorize their world according to familiar ways of making sense of encounters, such as events and themes (see Markman, 1989).

The nature of the developmental shift in language learning is evident in the performances of both 6-year-old groups. That 6-year-old children receiving the taxonomy list consistently recalled the greatest number of responses, possibly infers that as children are inducted into the formal education system, they develop greater language expertise, to the extent that taxonomy-based categorization becomes the more salient form of conceptual organization. At first glance, the strong performance of 6-year-olds receiving the script list might appear contradictory; however, this result confirms the argument that script-based structures provide a firm semantic foundation. Gardner (1991) argued that because scripts play an important life long role in helping to assimilate new experiences, they should not be viewed as immature or a lesser form of categorization. Markman (1989) stated that attending to causal, spatial, and temporal relations between objects is essential for understanding the world. She believed that it is a heightening of interest in categorical relations, and not a loss of interest in thematic relations that takes place with development (also see Mandler, 1983).

As predicted, there was no significant difference in memory performance between the two 5-year-old groups, nor between the performances of 5-year-olds and 4-year-olds, and 5-year-olds and 6-year-olds. These results lend weight to the theory that 5-year-old children experience a transitional period of shift from script-based to taxonomy-based structures of categorical organization, probably as a result of their introduction to formal schooling. The performances of 5-year-old children are of particular interest because they provide some insight into the nature of the transitional or shift stage. On the surface, the idea of development from one categorical stage to the next may imply an orderly forward progression, however, this does not appear to be the case. From their task performances across trials, 5-year-olds displayed less consistent, less stable behavior than the other two age groups. Vygotsky (1962), in describing the back and forth movement of lexical acquisition (a characterization which aptly describes the 5-year-old performances) suggested that novice language users need a period of exploration in order to strike a balance between existing ways of knowing and the disjunctions associated with entry into formal language learning situations. The process of structuring a new system of semantic organization from an

existing system appears to be a piecemeal process involving considerable experimentation with the relations among items in different categorical levels.

From these results, the inference is drawn that script-based categories have considerable strength and depth for young children, whereas hierarchical categorical organization is a more salient form of categorization for older children. This would suggest that emphasis should not be placed on viewing the script-based model in opposition to the taxonomy-based model, but rather, on acknowledging that script-based and taxonomy-based organization are elements of the same developmental process.

Educational and Future Research Implications

This study found strong support for the developmental theory that there are distinct, yet interrelated stages that mark children's lexical acquisition. The findings established that script-based categories, derived from children's experiences, combine to develop into larger taxonomic categories as children learn, or are taught how to reorganize their conceptual bases to better accommodate new experiences. This reorganization depends on experiences with language use, and learning of hierarchical relationships comes from experiences with language forms, facilitated by expert language users, rather than directly from experiences in the world.

Within the formal education system, this shift in categorical organization is facilitated primarily by expert language users, whose role is one of guaranteeing that children conform to socially prescribed naming practices and ways of thinking. It would appear that this transition is not just a simple case of learning to reorganize existing knowledge according to familiar structures; rather, it involves the learning of complex and abstract categories, quite different from what has already been assimilated. If this is so, the development of preschool and early elementary school language and literacy curriculums, which emphasize the role of contextual experiences in the development of taxonomic classification skills, should be a priority.

In the past, research has tended to focus on the development of categorical structures in isolation from the formal educational environment, thus leaving educators to make leaps of assumption based on open-ended theory. By examining the developmental shifts in the categorization of early words, this study was intended primarily as a foundation for the bridging of the gap between hypothetical and pragmatical perspectives. Building on the findings of this study, the next stage of research will address four crucial questions; (a) What are the scripts that children bring from the home culture to the formal language learning situation (classroom culture)?, (b) Are these scripts compatible with those which prevail in the classroom?, (c) What are the consequences for children with incompatible scripts?, and (d) What kinds of programs should be developed to accommodate the language development needs of these children?

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